

REMARKS

By this amendment, Applicants have amended claim 1, canceled claim 5, without prejudice, and added a new claim 21. As a result, claims 1-4 and 6-21 are pending in this application. These amendments are being made to facilitate early allowance of the presently claimed subject matter. Applicants do not acquiesce in the correctness of the objections and rejections and reserve the right to pursue the full scope of the subject matter of the original claims in a subsequent patent application that claims priority to the instant application. Reconsideration in view of the following remarks is respectfully requested.

The amendment of claim 1 presented herein was previously included in an After Final Response filed on 7 August 2006. In an Advisory Action dated 1 September 2006, the Office refused entry because the amendment allegedly raised new issues. These amendments are accompanied by a Request for Continued Examination and the corresponding fee. As a result, Applicants respectfully request entry of the amendments and consideration thereof.

I. Restriction Requirement

Additionally, Applicants again request that the Office reconsider and/or clarify its election/restriction requirement. In particular, Applicants respectfully submit that claim 1 and claim 14 do not “each contain mutually exclusive characteristics warranting a separate search”. As a result, Applicants respectfully request consideration of claims 10-15 in view of the Office’s search with respect to claim 1. In the alternative, Applicants request that the Office particularly point out that portion of claim 14 that warrants a separate burdensome search from that conducted for claim 1.

Further, Applicants respectfully submit that the previously presented and searched claim 6 and claim 19 do not “each contain mutually exclusive characteristics warranting a separate search”. As a result, Applicants respectfully request consideration of claims 16-20 in view of the Office’s previous search with respect to claim 6. In the alternative, Applicants request that the Office particularly point out that portion of claim 19 that warrants a separate burdensome search from that conducted for the previously presented claim 6.

II. Rejection under 35 U.S.C. § 103(a)

In the Final Office Action, the Office rejects claims 1-4 and 6-9 under 35 U.S.C. § 103(a) as allegedly being unpatentable over U.S. Patent No. 5,851,905 (McIntosh) in view of Applicants’ admitted prior art (APA). In order to establish a *prima facie* case of obviousness, the Office must show that (1) every feature is taught or suggested by McIntosh or the APA; (2) McIntosh, the APA, or generally available knowledge suggests or motivates the modification(s); and (3) one would have a reasonable expectation of success. MPEP 2143. Because the Office fails to establish a *prima facie* case of obviousness, Applicants respectfully request withdrawal of the rejections of claims 1-9 for the following reasons.

A. Claim 1

In particular, with respect to claim 1, the Office fails to show, *inter alia*, that McIntosh or the APA teaches or suggests, *inter alia*, the claimed applying a second precursor flux for a second element using a second pulse, wherein the second pulse has a second duration that is not equal to a first duration of a first pulse in a first series of pulses of a precursor flux for nitrogen, and wherein at least a portion of a pulse in the first series of pulses is applied at the same time that at least a portion of the second pulse is applied.

In support of its rejection, the Office cites FIGS. 12-13 and a portion of the corresponding discussion of McIntosh, which describe three variations of MOCVD growth methods. In a first growth method, all process gases flow into the growth chamber simultaneously. McIntosh, col. 10, lines 38-40. In a second growth method, “the organometallic process gases... are introduced into the growth chamber separately but with NH₃ flowing continuously.” McIntosh, col. 10, lines 40-54. A third growth method “involves introducing pulses of the gallium and indium organometallics together rather than sequentially, into the chamber, followed by an off-time in which the organometallic flows are stopped but during which the NH₃ continues to flow.” McIntosh, col. 10, lines 55-60. As a result, in each of the growth methods used by McIntosh and contrary to the claimed invention, NH₃ is continuously flowed.

The Office seeks to address this deficiency of McIntosh by combining McIntosh with the APA pulsed atomic layer epitaxy (PALE) growth technique. In PALE, a sequence of precursor flux pulses are used. Specification, paragraph 0006; FIG. 1. “In the sequence, only one precursor flux is pulsed at any given time 18... The duration of each pulse was set at approximately six seconds.” Results of PALE growth versus MOCVD are discussed extensively in the previously cited article “Pulsed Atomic Layer Epitaxy of Quaternary AlInGa_N Layers for Ultraviolet Light Emitters” by Zhang et al. (PALE article). As discussed in the PALE article, the PALE growth technique provided numerous advantages over the MOCVD growth technique.

1. The Office’s combination violates express teachings of McIntosh

Initially, Applicants note that the Office’s proposed combination goes against the express teachings of McIntosh. In particular, in each of the growth methods discussed in McIntosh, a

nitrogen precursor is continuously flowed. However, the Office proposes to change the McIntosh growth techniques by pulsing the nitrogen precursor. With this proposed change, the growth conditions for the layer are substantially altered. For example, in order to introduce the same amount of nitrogen into the growth chamber, one would need to provide a higher quantity of nitrogen per unit time. Further, McIntosh, while teaching that flows for other elements can be pulsed, expressly teaches that the nitrogen precursor is to flow continuously. Consequently, McIntosh clearly treats the nitrogen precursor differently from the precursors for other elements. As a result, the Office's proposal to modify McIntosh's nitrogen precursor flow by using Applicants' claimed series of pulses goes against the express teachings of McIntosh.

2. Simultaneous pulsing is not taught in McIntosh or APA

Further, Applicants submit that such a substantial change to the growth techniques of McIntosh is not taught or suggested by the prior art PALE growth technique. For example, a significant difference between the PALE and MOCVD growth techniques is the method in which nitrogen is introduced into the growth environment. In particular, in the prior art PALE technique, contrary to any of the MOCVD techniques discussed in McIntosh, the nitrogen precursor is: (a) pulsed; and (b) is not flowing at the same time as a precursor for another element. To this extent, the significant benefits of PALE over MOCVD discussed in the PALE article indicate that such non-simultaneous nitrogen precursor pulsing is important to the improved growth. In fact, the PALE technique has been widely researched and used simultaneously with the MOCVD technique, and Applicants are unaware of any proposal to pulse a nitrogen precursor simultaneously as a precursor for another element as in the claimed invention. To this extent, Applicants respectfully submit that the benefits provided by the prior

art PALE technique teach against pulsing a nitrogen precursor at the same time that at least a portion of pulse for a second element is applied.

Additionally, with respect to the newly added claim 21, McIntosh, the APA, or the combination thereof fails to teach or suggest the claimed sequential flows. In particular, the sequential flows can result when, for example, a pulse for the first precursor flux partially overlaps a pulse for the second precursor flux. Such a partial overlapping clearly is not taught or suggested by McIntosh, which does not teach pulsing a nitrogen precursor flux, and therefore cannot include a flow that does not include the first precursor flux. Additionally, the partial overlapping clearly is not taught or suggested by the APA, which expressly requires that “only one precursor flux is pulsed at any given time”, Specification, paragraph 0006, and therefore cannot include a flow that includes both the first and second precursor fluxes. As a result, Applicants respectfully submit that the combination of McIntosh and the APA, even if, *arguendo*, proper, fails to teach or suggest the claimed series of flows.

3. No motivation for combination

Further, the Office fails to show that McIntosh, the APA, or generally available knowledge suggests or motivates the Office’s proposed modification. In support of its rejection, the Office alleges that such motivation is found “because the PALE technique results in GaN layers with greater control over lattice mismatch and strain”. Final Office Action, page 3. Initially, Applicants note that the Office misquotes Applicants’ specification. In particular, the portion quoted by the Office states that “[i]ncluding In in one or both of the AlGaN and GaN layers has been shown to provide greater control over lattice mismatch and strain in the structure.” Specification, paragraph 0005. Consequently, the Office’s motivation is based on a

clear misreading of Applicants' specification, and is not supported by the APA or McIntosh. Further, as discussed above, in the prior art PALE technique, "only one precursor flux is pulsed at any given time". Specification, paragraph 0006. As a result, without the benefit of the hindsight of Applicants' claimed invention, the express teachings of the APA teach against the claimed application of at least a portion of a nitrogen precursor pulse at the same time that at least a portion of the second pulse is applied.

4. Conclusion

In light of each of the above-stated reasons, either alone or in combination, Applicants respectfully submit that the Office has failed to establish a *prima facie* case of obviousness. As a result, Applicants respectfully request withdrawal of the rejection of claim 1 and claims 2-4, and 6-9, which depend therefrom, as allegedly being obvious over McIntosh in view of the APA.

B. Claim 6

With further respect to claim 6, the Office again cites FIG. 14 of McIntosh as allegedly disclosing the claimed feature of a pulse having a non-rectangular waveform. However, as discussed in Applicants' previous response and not addressed in the Office's Final Office Action, FIG. 14 merely illustrates a relationship between hydrogen flow rate and indium incorporation for a particular MOCVD system. See, e.g., Col. 4, lines 30-32. To this extent, FIG. 14 fails to teach using a pulse at all, let alone using a pulse having a non-rectangular waveform as in the claimed invention. As a result, Applicants again respectfully request withdrawal of the rejection of claim 6 as allegedly being obvious over McIntosh in view of the APA.

C. Claim 7

With further respect to claim 7, the Office again cites Col. 8, lines 30-40 of McIntosh as allegedly disclosing the claimed illuminating the nitride-based film with ultraviolet radiation while growing a nitride-based film. However, as discussed in Applicants' previous response and not addressed in the Office's Final Office Action, this portion of McIntosh merely compares the efficiency of quantum well light emitting diodes with standard technologies. To this extent, this discussion is entirely unrelated to growing a nitride-based film, let alone illuminating the nitride-based film with ultraviolet radiation. As a result, Applicants again respectfully request withdrawal of the rejection of claim 7 as allegedly being obvious over McIntosh in view of the APA.

III. Conclusion

Applicants submit that each of the pending claims is patentable for one or more additional unique features. To this extent, Applicants do not acquiesce to the Office's interpretation of the claimed subject matter or the references used in rejecting the claimed subject matter. Additionally, Applicants do not acquiesce to the Office's combinations and modifications of the various references or the motives cited for such combinations and modifications. These features and the appropriateness of the Office's combinations and modifications have not been separately addressed herein for brevity. However, Applicants reserve the right to present such arguments in a later response should one be necessary.

In light of the above, Applicants respectfully submit that all claims are in condition for allowance. Should the Examiner require anything further to place the application in better condition for allowance, the Examiner is invited to contact Applicants' undersigned representative at the number listed below.

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'J. W. LaBatt' with a stylized flourish at the end.

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